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Original Research Article

Clinico-pathological and etiological evaluation of acute appendicitis and assessment of significance of laboratory and ultrasonography examination as an ancillary aid to clinical diagnosis

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ABSTRACT

Background: Timely diagnosis and intervention of acute appendicitis reduces morbidity and mortality associated with the disease condition. The study aimed to evaluate the etiology of acute appendicitis, to analyze the sensitivity of modified Alvarado scoring system and radiology in the diagnosis of acute appendicitis and to correlate the observations of laboratory tests, operative findings with the histopathological report of specimen of appendix.
Methods: This was a prospective study done on 100 patients with clinical symptoms of acute right lower abdominal pain suggestive of appendicular origin during the period from February 2015 to January 2016 in the department of surgery thorough clinical assessment, laboratory investigations, ultrasound findings as were done for all patients. After confirming the diagnosis of AA the patients had operative intervention and specimens were sent for histopathological study.
Results: Male preponderance was seen in the study. Majority of them belongs to 21 to 30 years age group (50%). Faecolith was the most common etiological factor observed (58%). Abdominal pain (100%) was the most common clinical symptom. Alvarado score had sensitivity of 95.74% and specificity of 66.67% in diagnosing AA. In correlation to histopathological findings, ultrasonography findings showed 100% positive visualization rate in all 71 cases. Elevated ESR (94%) had high diagnostic accuracy as confirmed by HPE finding (96.81%) which is statistically significant ($p<0.000$).
Conclusions: Alvarado scoring system, elevated ESR levels and USG findings of the appendix can be considered as adjuncts to clinically diagnose the AA, to improve the diagnostic accuracy thereby consequently the rate of negative appendicectomy can be reduced and thus decreases the complication rates.

Keywords: Clinico-pathology, Etiology, Acute appendicitis, Ultrasonography

INTRODUCTION

Acute appendicitis is a clinicopathological condition with severe abdominal pain. It is commonly seen in the second to fourth decade of life affecting about 7% of the population during their life time and woman (25%) are more likely affected than men (13%).[1] The diagnosis of the appendicitis based on the findings of physical examination and patients history.[2,3] One of the criteria for diagnosis based on clinical signs and examinations is the Alvarado standard, which includes symptoms (abdominal pain and migration, nausea and vomiting), signs (anorexia, tenderness and rebound tenderness, fever), and laboratory criteria (leukocytosis and left shift).[4] Timely diagnosis of appendicitis reduces the complication rate and mortality.[5]

Some patients lack the typical symptoms of appendicitis, hence clinical diagnosis of the disease based on symptoms and patient history alone is not sufficient in understanding clinical condition of the patients. In such patients laboratory investigations and more specific diagnostic methods such as laparoscopy, computed tomography (CT) scan and ultrasonography (USG) should be done. In adults which lack perfect clinical symptoms and suspected to acute appendicitis USG can be used to diagnose the exact clinical condition.[6,7]

High rates of negative appendectomy (operation without histological confirmation of appendicitis) have been reported in some groups like females of reproductive age (about 26%) due to non specific clinical features of acute appendicitis. A complication rate of up to 6.1% following removal of normal appendices had been reported.[8]

The current study was done with the aim to find out the etiologies of acute appendicitis and to analyze the sensitivity of modified Alvarado scoring system and radiology in the diagnosis of acute appendicitis and to correlate the observations of laboratory tests, operative findings with the histopathological report of specimen of appendix.

METHODS

This was a prospective study conducted on 100 patients attending General Surgery, Emergency and out-patient department of KPC Medical College and Hospital, Kolkata, with clinical symptoms of acute right lower abdominal pain suggestive of appendicular origin during the period from February 2015 to January 2016. After getting approval from institutional ethics committee, patients of both sexes with age group of more than 12 years or more, and who gave consent to participate in the study were included. Patients of age group less than 12 years, signs and symptoms suggestive of appendicular mass or abscess, patient with other pre-existing illeoceacal pathology like tuberculosis or malignancy, patients with recurrent appendicitis and who are not willing to participate in the study were excluded.

Complete clinical and detailed patient history with symptoms including right lower quadrant pain or periumbilical pain migrating to the right lower quadrant with anorexia, nausea and or vomiting, fever >38 degree celsius were collected. Right lliac fossa guarding and tenderness on physical examination were observed. Base-line investigations (full blood count, ESR, CRP, USG abdomen and peripheral smear for shift to left) were done.

Specially designed semi structured socio-demographic proforma is filled in for each patient along with eight variables based on Alvarado scoring system. Then the sum of all the scores was calculated for each patient.

Surgery (appendicectomy) was done under general or spinal anaesthesia. When the diagnosis of acute appendicitis was certain a grid-iron incision was used. Midline incision was used when diagnosis was uncertain or frank peritonitis was suspected. Intra-operatively, the etiology of appendicitis was determined and noted. The specimen of appendix after resection was sent for histopathological examination and the reports were subsequently analysed.

The correlation of clinical presentation and examination was made with USG findings, laboratory findings, operative and pathological findings.

All the data collected were analysed and presented in number and percentages. Chi square test was used to compare the diagnostic value of assessed parameters with histopathology. P value less than 0.05 were considered statistically significant.

RESULTS

Table 1 presents the demographic and clinical characteristics of patients. In the current study, from 100 patients from suspected to acute appendicitis participated, 61 were males and 39 were females. Majority of them belongs to 21 to 30 years age group. Faecolith was the most common etiological factor with worm more in younger age group (58%). Abdominal pain (100%) is the most common clinical symptom noticed in all the patients followed by nausea/vomiting (97%). Right lliac fossa tenderness (26%) and rebound tenderness (26%) were the most common clinical signs observed followed by leukocytosis (24%). Among the other signs Rovsing sign (40%) is the most common followed by Obturator sign (33%) and Psoas sign (27%). About 92% of the study population had Alavarado score of 7 to 10 notifying likely to have appendicitis and remaining 8% had score less than 7 (may be appendicitis).

As shown in Table 2, maximum elevation of ESR (90%) was seen when Alvarado score is in between 7 to 10 with normal (3%) to low (l%) ESR when Alvarado score is in between 5 to 6. Maximum elevation of CRP (74%) is seen when Alvarado score is in between 7 to 10 (Table 2).

Table 3 presents the distribution of study population according to USG, operative and histopathological findings. Around two third (62%) of the study population was radiologically diagnosed with acute appendicitis with no abnormality detected in 23% of the population. Intra-operatively around three-forth (73%) of the study population was diagnosed with acute appendicitis followed by perforated appendicitis (12%). Appendix was not inflamed in7% of the study population. Histopathologically, acute appendicitis was the most common (51%) followed by chronic appendicitis (17%), gangrenous appendicitis (14%) and perforated appendicitis (12%). No abnormality detected in 6% cases.

Table 1: Patient characteristics.

Characteristics	Total (n=100)
Age (in years)	
Up to 20	15
21-30	50
31-40	31
>40	4
Sex	
Male	61
Female	39
Etiology	
Faecolith	58
Fibrosis	19
Worm	1
Nonspecific	22
Clinical symptoms	
Abdominal pain	100
Nausea/vomiting	97
Anorexia	92
Burning sensation	23
Constipation	18
Diarrhoea	24
Clinical signs	
Right lilac fossa tenderness	100
Rebound tenderness	99
Fever	79
Total leucocyte count	92
Shift to left	11
Rovsing sign	19
Psoas sign	13
Obturator sign	16
Alavardo score	
Likely appendicitis (score: 7-10)	92
May be appendicitis (score: <7)	8

According to Alvarado scoring 7-10 appendicitis was present in 34 cases and with scoring <7, 1 case was shown positive for appendicitis and the difference was found to be statistically significant ($p<0.05$). In the present study, the overall diagnostic accuracy of Alvarado score had sensitivity of 95.74% and specificity of 66.67%.

Study population that was diagnosed to have acute appendicitis in USG report had 100% confirmation by HPE report but 20.69% of the population had positive HPE report in spite of been radiologically negative (n=23). This difference is statistically significant. Study populations having elevated ESR (94%) have high diagnostic accuracy as confirmed by HPE finding which is statistically significant (Table 4).

Table 2: Comparison of Alvarado score distribution of study cases with ESR and CRP values.

Parameters	Alvarado score		
	7-10	5-6	1-4
ESR			
Elevated	90	4	0
Normal	2	3	0
Low	0	1	0
CRP values			
High (>3 mg)	74	1	0
Average (1-3 mg)	18	6	0
Low (<1 mg)	0	0	0

Table 3: Distribution of study population according to USG, operative and histopathological findings.

Findings	USG findings	Operative findings	Histo-pathology
Acute appendicitis	62	73	51
Chronic appendicitis	-	-	17
Gangrenous appendicitis	5	8	14
Mesenteric lymphadenitis	2	1	-
Meckel diverticulum	-	3	-
Perforated appendicitis	4	12	12
Pelvic inflammatory appendicitis	4	3	-
No abnormality detected	23	-	6

Table 4: Comparison of Alvarado scoring, USG and elevated ESR with histopathological findings.

Findings	Histopathology findings			P value
	Appendicitis	No appendicitis	Total	
Alavardo score				
Likely appendicitis (score: 7-10)	34	2	36	0.024
May be appendicitis (score: <7)	1	2	3	
USG findings				
Present	71	0	71	<0.0001
Absent	23	6	29	
ESR				
Elevated	91	3	94	<0.0001
Normal-low	3	3	6	

DISCUSSION

Our present study was under taken to evaluate the significant and usefulness of Alvarado scoring system, laboratory tests and importance of basic radiological investigations like ultrasonography in reducing the number of negative appendicectomy and to evaluate its sensitivity and positive predictive value in diagnosis of acute appendicitis and also to evaluate the different etiological factors causing acute appendicitis.

In the present series, majority of the study population was male; rest (39%) was female and peak incidence are found from 21 to 30 years was (50%). 31% of study population was within the age group of 31 to 40 years. Only 4% study population was aged more than 40 yrs. This was in accordance with the findings of Patra et al.[9]

Abdominal pain (100%) was the most common presenting clinical symptom which is localised to RIF in most of the cases followed by nausea/vomiting (97%), anorexia (92%). Tenderness over right lliac fossa (100%) was the most commonly detected clinical sign. Similar observations were also seen in the studies done by Ramole et al.[10]

Obstruction of lumen of appendix considered to be the common cause of acute appendicitis.[11] As per reports noted by Brunicardi et al faecolith alone causes simple appendicitis in 40%, gangrenous non-perforated appendicitis in 65%, and perforated appendicitis in 90% of cases.[12] In our study, faecolith is the main etiological factor identified in 58 cases.

In our study, according to Alvarado scoring system, 92% of the study population had a score between 7 to 10 (likely appendicitis) and 8% subjects had the score of 5-6. The sensitivity of Alvarado score in diagnosing acute appendicitis is maximum in our study (95.74%). This was in accordance with the studies of Denizbasi et al (95.4%) and Shrivastava et al (92.4%).[13,14] However the specificity of scoring was lesser (66.67%) as compared to the study of Patra et al (89.4%).

In the present study, out of 100 patients who underwent ultrasonography, acute appendicitis was visualized in 77 patients. Of these, 71 cases had confirmed appendicitis on histopathological examination giving a positive visualization of 100%. This was similar to the studies of Jeffrey et al and Joshi et al who, in their studies have reported the positivity of visualization of appendix on ultrasonography 97.5 and 98%.[15,16]

As per the reports of Yildirim et al, the risk of complication of acute appendicitis increases significantly with increased levels of CRP and ESR.[17] In our series, study populations having elevated ESR (94%) have high diagnostic accuracy as confirmed by HPE finding (96.81%) which is statistically significant. In our study, CRP level did not effectively predict the diagnosis of appendicitis. Study population having a high CRP pre-operatively had a higher positivity rate (96%) on HPE report but populations having average-low CRP also had higher positivity rate (88%) but the difference is not significant. Among the inflammatory markers evaluated in our study to diagnose and confirm appendicitis, ESR had emerged as a better and easier tool for suspecting acute appendicitis.

CONCLUSION

After thorough study it can be easily concluded that Alvarado score along with basic radiological studies like abdominal USG and laboratory tests like ESR and CRP is very effective in the diagnosis of acute appendicitis in young adults to rule out pelvic pathology. The most common etiology of acute appendicitis in this study has been faecolith, so much emphasis must be placed in practicing good food habits with hygiene. The application of Alvarado scoring system, evaluated elevated ESR levels and USG findings as adjuncts to clinical diagnosis improves the diagnostic accuracy and consequently reduces negative appendicectomy and thus reduces complication rates.

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